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NATIONAL DAM SAFETY PROGRAM. WEATHERBY DAM (MO 10690), MISSOURI--ETC(U)
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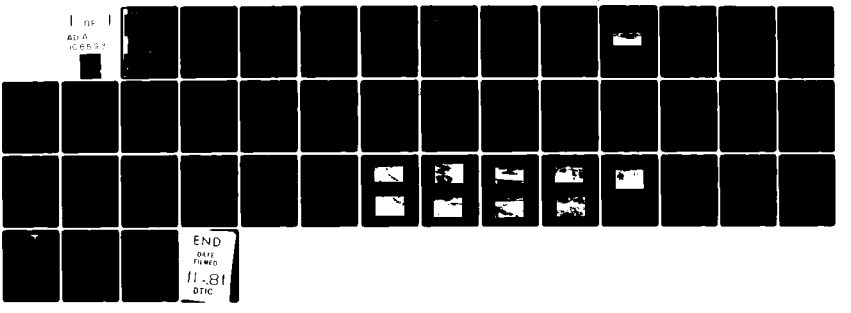

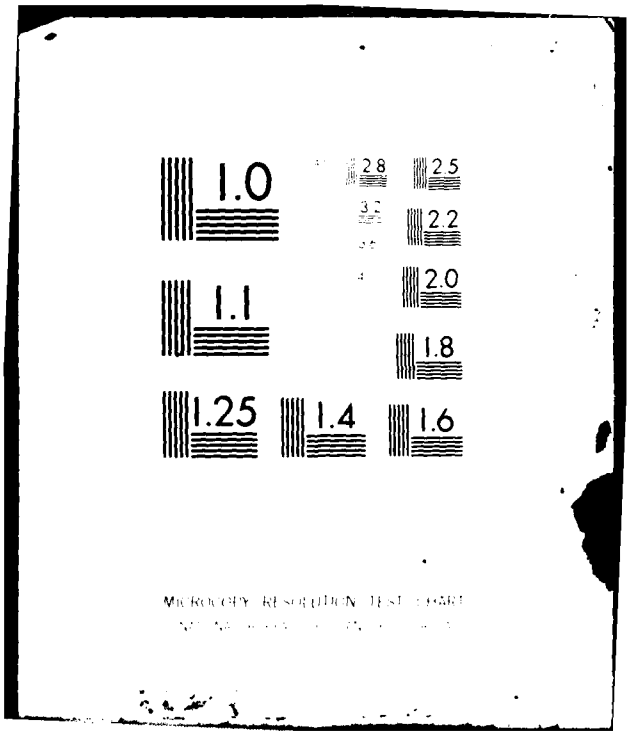
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MISSOURI-KANSAS CITY BASIN

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AD A104593

WEATHERBY DAM
PLATTE COUNTY, MISSOURI
MO. 10690

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST.

FOR: STATE OF MISSOURI

P

SEPTEMBER 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
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4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Weatherby Dam (MO 10690) Platte County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report
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17. Paul R. /Zaman Bruce A. /Ainsworth
Wayne H. /McElwee

(if different from Report)

National Dam Safety Program. Weatherby Dam (MO 10690), Missouri - Kansas City Basin, Platte County, Missouri. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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MISSOURI-KANSAS CITY BASIN

WEATHERBY DAM
PLATTE COUNTY,MISSOURI
MO. 10690

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST.

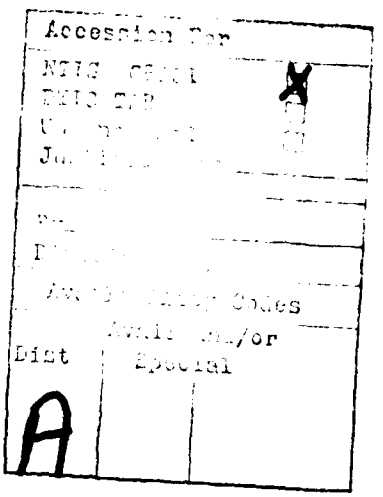
FOR: STATE OF MISSOURI

SEPTEMBER 1978

WEATHERBY DAM

PLATTE COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10690



PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY:

BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

UNDER DIRECTION OF

ST. LOUIS DISTRICT CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

SEPTEMBER 1978

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Weatherby Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Weatherby dam:

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood.
2) Overtopping could result in dam failure,
3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED — 8 NOV 1978
Chief, Engineering Division — Date

APPROVED BY: SIGNED — 8 NOV 1978
Colonel, CE, District Engineer — Date

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Weatherby Dam
State Located	Missouri
County Located	Platte County
Stream	Rush Creek
Date of Inspection	5 September 1978

Weatherby Dam was inspected by a team of engineers from Black & Veatch, Consulting Engineers for the St. Louis District, Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and state agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as an intermediate size dam with a high downstream hazard potential. According to the St. Louis District, Corps of Engineers failure would threaten the life and property of approximately 10 families downstream of the dam and would potentially cause appreciable damage to the bridges of two improved roads in the estimated damage zone which extends 8 miles downstream of the dam.

Our inspection and evaluation indicate the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillway will pass 20 percent of the probable maximum flood without overtopping.

Deficiencies visually observed by the inspection team were erosion on downstream slope and abutment contacts, seepage at left abutment and below spillway area, localized riprap movement, sliding of a portion of the embankment, undercutting of spillway apron, and presence of excessive brush and small trees on the downstream embankment slope.

There were no observed deficiencies or conditions existing at the time of the inspection which indicated an immediate safety hazard. Future corrective action and regular maintenance will be required to correct or control the described deficiencies. In addition, an engineer experienced in the design of earthen dams should be retained by the owner to make detailed seepage and stability analyses of the existing dam. A detailed report discussing each of these deficiencies is attached.

Paul R. Zaman

Paul R. Zaman, PE
Illinois 62-29261

Bruce A. Ainsworth

Bruce A. Ainsworth, PE
Missouri E-18023

Wayne H. McElwee

Wayne H. McElwee, Partner
Black & Veatch

Overview of Lake and Dam

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
WEATHERBY DAM

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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the District Engineer of the St. Louis District, Corps of Engineers, directed that a safety inspection of the Weatherby Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure located in a valley of Rush Creek in south-central Platte County, Missouri (Plate 1). A roadway has been constructed across the top of the dam. Topography of the contributing watershed is characterized by rolling hills. The watershed is primarily comprised of residential areas and farmland. Topography in the vicinity of the dam is shown on Plate 2.

(2) The spillway is a low water crossing on the roadway at the right abutment. The approach channel is excavated through the existing limestone and soil and a concrete paved discharge apron exits onto weathered limestone.

(3) A 24-inch diameter lake drawdown pipe runs through the upper portion of the embankment. This pipe is located to the immediate left of the spillway area and discharges onto the spillway discharge apron. A manually operated gate with rising stem is located at the upstream edge of the existing shoulder of the dam.

(4) Pertinent physical data are given in paragraph 1.3.

b. Location. The dam is located in the south-central portion of Platte County, Missouri, as indicated on Plate 1. The lake formed by the dam is shown on the United States Geological Survey 7.5 minute series quadrangle map for Parkville, Missouri - Kansas in Sections 10, 11, 14, 15, 32, T51N, and R45W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, the dam and impoundment are in the intermediate size category.

d. Hazard Classification. The hazard classification assigned by the Corps of Engineers for this dam is as follows: The Weatherby Dam has a high hazard potential, meaning that the dam is located where failure may cause loss of life; serious damage to homes; and extensive damage to agricultural, industrial and commercial facilities, and important public utilities, main highways, or railroads. For the Weatherby Dam the flood damage zone extends downstream for 8 miles. Ten homes and 2 improved road crossings are within the damage zone.

e. Ownership. The dam is owned by Weatherby Lake Improvement Company located at 7200 N.W. Eastside Drive, Kansas City, Missouri 64152.

f. Purpose of Dam. The dam forms a 186-acre recreational lake.

g. Design and Construction History. The dam was constructed in about 1936. The engineers on construction of the dam and lake site were the Hands Surveying Company. Fred E. Botts was the grading contractor for contruction of the dam. No other data relating to the design and construction was available.

h. Normal Operating Procedure. Normal rainfall, runoff, transpiration, and evaporation all combine to maintain a relatively stable water surface elevation.

1.3 PERTINENT DATA

a. Drainage Area - 2,750 acres.

b. Discharge at Damsite.

(1) Normal discharge at the damsite is through an uncontrolled spillway. The water level could be lowered 3 feet below normal pool elevation by use of the 24-inch diameter lake drawdown pipe.

(2) Estimated experienced maximum flood at damsite - May 17-18, 1974 when freeboard on the dam was reduced to approximately 9 inches.

(3) Estimated ungated spillway capacity at maximum pool elevation - 1,900 cfs (top of dam El. 901.0).

c. Elevation (Feet Above M.S.L.).

(1) Top of dam - 901.0 ± (see Plate 3)

(2) Spillway crest - 897.0

(3) Streambed at centerline of dam - 815 ±

(4) Maximum tailwater - Unknown

d. Reservoir.

(1) Length of maximum pool - 9,050 feet ±

(2) Length of normal pool - 7,750 feet ±

e. Storage (Acre-feet).

(1) Top of dam - 5,750

(2) Spillway crest - 4,850 (from 1973 inventory)

(3) Design surcharge - Not available.

f. Reservoir Surface (Acres).

(1) Top of dam - 242

(2) Spillway crest - 186

g. Dam.

(1) Type - Earth embankment

(2) Length - 1,100 feet

(3) Height - 85 feet ±

(4) Top width - 40 feet

(5) Side Slopes - (see Plate 5)

(6) Zoning - Unknown

(7) Impervious core - Unknown

(8) Cutoff - Unknown

(9) Grout curtain - Unknown

h. Diversion and Regulating Tunnel - none.

i. Spillway.

(1) Type - Concrete and rock (see paragraph 3.1c)

(2) Length of weir - 120 feet (see paragraph 3.1c)

(3) Crest elevation - 897.0 feet m.s.l.

(4) Gates - None

(5) Upstream channel - Weathered limestone and soil with grass-lined bottom.

(6) Downstream Channel - Broken limestone and shale. No side slope protection on west side. Natural plunge pool at termination of channel.

j. Regulating Outlets - 16 gage, 24-inch diameter, bituminous-coated corrugated metal pipe with gate attached at the upstream edge of the existing shoulder of the dam. According to the specifications, the 312 feet of pipe shall be laid with a gradient of two percent fall and the inlet invert at an elevation of 894.0 feet.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Design data was unavailable. However, the engineering data available pertained to past maintenance that was performed on the dam. (See Section 4.2 for further details).

2.2 CONSTRUCTION

Construction records were unavailable, but the dam was reportedly built in approximately 1936. The engineers on the construction of the dam and lake site were the Hands Survey Company, while Fred E. Botts was the grading contractor for construction of the dam.

2.3 OPERATION

The maximum recorded loading on the dam was May 17-18, 1974 (See Section 1.3b.(3) for further details).

2.4 EVALUATION

a. Availability. Engineering data on the past maintenance of the dam were available from Williamson Engineering and Surveying of St. Joseph, Missouri. Larkin and Associates Consulting Engineers of Kansas City, Missouri have proposed modifications to the existing spillway and dam which have not yet been implemented. No other engineering data were found.

b. Adequacy. The engineering data available were inadequate to make a detailed assessment of design, construction, and operation. Detailed seepage and stability analyses should be performed for this dam.

c. Validity. The engineering data available were insufficient to determine the validity of the design, construction, and operation.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Weatherby Dam was made on 5 September 1978. The inspection team included professional engineers with experience in dam design and construction, hydrology - hydraulic engineering, and geotechnical engineering. Specific observations are discussed below. No observations were made of the condition of the upstream face of the dam below the pool elevation at the time of the inspection.

b. Dam. The inspection team observed the following items at the dam. Some movement of the riprap material near the left end of the dam was noted. Also there is a small trench just above the riprap along the upstream face of the dam. It was difficult to determine whether this has been caused from actual wave runup above the riprap or if it is the result of a construction practice while placing the riprap. Generally, the riprap is intact and in good condition. On the downstream embankment surface shrinkage cracks and erosion ditches were observed. The shrinkage cracks appeared to be superficial extending approximately 3 inches deep. Some of the erosion ditches near the toe were about 2 feet deep. Approximately 500 feet of translational sliding of the downstream embankment parallel to the centerline of the dam was discovered near the toe close to the left abutment. The sliding was approximately 30 feet long and 3 feet deep. Shrinkage and/or tension cracks associated with the upslope extremity of the sliding area were observed. The depth of these cracks ranged to about 12 inches deep. Seepage was observed in the left abutment and in the right abutment near the plunge pool. The seepage observed was noted as being clear and flowing at approximately 50 gpm. There were numerous small trees and a heavy stand of weeds on the downstream slope.

c. Appurtenant Structures. The approach channel is excavated in weathered limestone and soil with a grass-lined bottom at the right abutment. The spillway is paved as it crosses the road where it flows onto a concrete discharge apron. The concrete of the discharge apron appears to be in good condition although there is a small amount of undercutting of this apron. From the concrete apron the water spills into a limestone and shale discharge channel, where side slope protection is provided on the left side but none is provided on the right side. The discharge channel runs approximately 300 feet, then flows into a natural plunge pool. Seepage was sighted in several locations in the limestone and shale formations near this pool.

The 24-inch diameter lake drawdown pipe and gate well appeared to be in good condition at the time of inspection. The pipe runs through the upper portion of the embankment where it spills onto the concrete discharge apron. The operator handle was missing; thus, the gate could not be checked for operation. No water was discharging through the outlet culvert at the time of inspection.

d. Reservoir Area. No slides or excessive erosion due to wave action were observed along the shore of the reservoir.

e. Downstream Channel. Heavy vegetation and mild channel slopes typical of streams in the area characterize the channel downstream of the spillway and plunge pool area (see position of Photo 8, Plate 3). A bridge crossing the downstream channel is located less than one-half mile from the spillway.

3.2 EVALUATION

a. None of the conditions observed are significant enough to indicate a need for immediate remedial action.

b. The deficiencies noted at the time of the inspection have the following significance:

(1) The movement of riprap on the upstream face exposes the embankment material to wave action.

(2) Small trees and brush are a potential seepage hazard, prevent inspection of the slope, and provide animal habitat.

(3) The surface shrinkage cracks observed on the downstream embankment slope concentrate surface runoff which increases erosion. Shrinkage and/or tension cracks associated with the sliding area will accelerate additional sliding following periods of rainfall and freeze-thaw.

(4) Undercutting of the spillway or seepage in the abutments if uncontrolled could lead to a piping condition.

(5) Multiple translational slides develop gradually and spread backward along a common failure surface decreasing the stability of the dam.

If these conditions continue unchecked, a serious potential for failure will develop.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Controlled outlet works exist, but are apparently not used. If the 24-inch diameter lake drawdown pipe were used, the normal pool could be lowered by 3 feet. The pool is primarily controlled by rainfall, runoff, evaporation, and capacity of the uncontrolled spillway.

4.2 MAINTENANCE OF DAM

Some of the maintenance history was available in the form of drawings, contracts, and letters found in old files of E. I. Myers, Consulting Engineer which are currently in the custody of Williamson Engineering and Surveying, St. Joseph, Missouri. It appears that the tie-in of the dam abutments to the natural strata in the valley walls at the time of initial construction was inadequate. In 1951 E. I. Myers was asked to inspect the dam and make recommendations for the improvements of the dam. In his report Myers defined seepage problems in the left and right abutments. In 1953 P. S. Judy, geologist and engineer, made a survey of the dam and drew basically the same conclusions as E. I. Myers. Under the guidance of E. I. Myers, in 1954 an impervious core trench was constructed in the right abutment to help control seepage in the area. In 1955 a new outlet spillway was constructed. A clay blanket was placed on the left abutment in 1956 to try and curb seepage in this abutment. In 1959 the seepage in the right abutment increased to approximately 300 gallons per minute. An attempt was made in 1961 to pump grout into the right abutment but it was abandoned because it was not economically feasible. In 1962 a line of holes was drilled from the right abutment below the weathered limestone to the top of a shale formation where sheet piling was driven approximately 3 feet into the shale; bulk concrete was then poured between the sheet piling and the holes. A report was prepared by A. J. Spiegel, Consulting Engineer and Larkin and Associates, Consulting Engineers in 1974 for the relocation of the existing spillway and improvements to the dam embankment. At the present time these modifications have not been implemented.

4.3 MAINTENANCE OF OPERATING FACILITIES

The 24-inch diameter lake drawdown pipe was installed in 1970. Apparently, no maintenance has been performed on this structure since its construction.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION

Existing seepage, erosion, small trees and brush growth on the downstream embankment, and sliding observed on the downstream side of the dam increases the potential for failure and warrants regular monitoring and control.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. Design data pertaining to hydrology and hydraulics were unavailable.

b. Experience Data. The drainage area and lake surface area are developed from USGS Parkville and Ferrelview Quadrangle Maps. The spillway and dam layout are from surveys made during the inspection and an aerial topographic map made in the spring of 1978.

c. Visual Observations.

(1) Concrete spillway and the spillway discharge apron are in good condition.

(2) Drawdown facilities are available to lower the normal pool by 3 feet, see paragraph 3.1c.

(3) The spillway and exit channel are located at the right abutment. Spillway releases will not endanger the integrity of the dam.

d. Overtopping Potential. The spillway will not pass the probable maximum flood, which is the spillway design flood recommended by the guidelines, without overtopping. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The spillway will pass 20 percent of the probable maximum flood without overtopping. This flood is greater than the 100-year flood estimated according to the methodology outlined by the USGS in "Technique for Estimating the Magnitude and Frequency of Missouri Floods". According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, a high hazard dam of intermediate size should pass 100 percent of the probable maximum flood. The portion of the estimated peak discharge of the probable maximum flood overtopping the dam would be 14,200 cfs of the total discharge from the reservoir of 22,100 cfs. The estimated duration of overtopping is 8.7 hours. The portion of the estimated peak discharge of 50 percent of the probable maximum flood overtopping the dam would be 2,600 cfs of the total discharge of the reservoir of 7,200 cfs. The estimated duration of overtopping is 5.8 hours. Failure of upstream water impoundments shown on the 1975 revised USGS map would not have a significant impact on the hydrologic or hydraulic analysis.

According to the St. Louis District, Corps of Engineers, the effect from rupture of the dam could extend approximately 8 miles downstream of the dam. There are 10 inhabited homes and 2 improved road crossings downstream of the dam which could be severely damaged and lives could be lost should failure of the dam occur.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of conditions which affect the structural stability of this dam are discussed in Section 3, paragraph 3.1b.

b. Design and Construction Data. No design data relating to the structural stability of the dam were found.

c. Operating Records. No operational records exist.

d. Post Construction Changes. Apparently several modifications, which are discussed in Section 4.2, have been made at the dam. The latest proposals by Larkin and Associates, Consulting Engineers would improve the existing structural stability of the dam.

e. Seismic Stability. The dam is located in the Seismic Zone 1 which is a zone of minor seismic risk. A properly designed and constructed earth dam using sound engineering principles and conservatism should pose no serious stability problems during earthquakes in this zone.

The seismic stability of an earth dam is dependent upon a number of factors: embankment and foundation material classification and shear strengths; abutment materials, conditions, and strength; embankment zoning; and embankment geometry. Adequate description of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment was not available and therefore no inferences will be made regarding the seismic stability.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Items noted during the visual inspection by the inspection team which should be monitored or controlled are movement of upstream riprap, seepage through the abutments, sliding and eroding of the downstream embankment slope, undercutting of the concrete discharge apron, and an uncontrolled stand of brush and small trees on the downstream embankment slope.

b. Adequacy of Information. Due to the unavailability of engineering design data, the conclusions in this report were based only on performance history and visual conditions. The inspection team considers that the performance history and the observed conditions are sufficient to support the conclusions herein. Due to the lack of data, detailed analyses of the dam comparable in scope to the requirements of Chapter 4 of the Recommended Guidelines should be performed.

c. Urgency. A program should be developed as soon as possible to monitor at regular intervals the deficiencies described in this report. The remedial measures recommended in paragraph 7.2 could be accomplished now or delayed until observations of this monitoring program and/or the recommendation of a qualified engineer indicate the necessity of immediate action. If the safety deficiencies listed in paragraph 7.1a are not corrected, they will continue to deteriorate and lead to a serious potential of failure. Presently immediate action is not considered necessary.

d. Seismic Stability. This dam is located in Seismic Zone 1. Adequate description of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment was not available and therefore no inferences will be made regarding the seismic stability.

7.2 REMEDIAL MEASURES

a. Alternatives. In order to pass the probable maximum flood as required by the Recommended Guidelines, the spillway size and/or height of dam would need to be increased.

b. O&M Maintenance and Procedures. The following O&M maintenance and procedures are recommended:

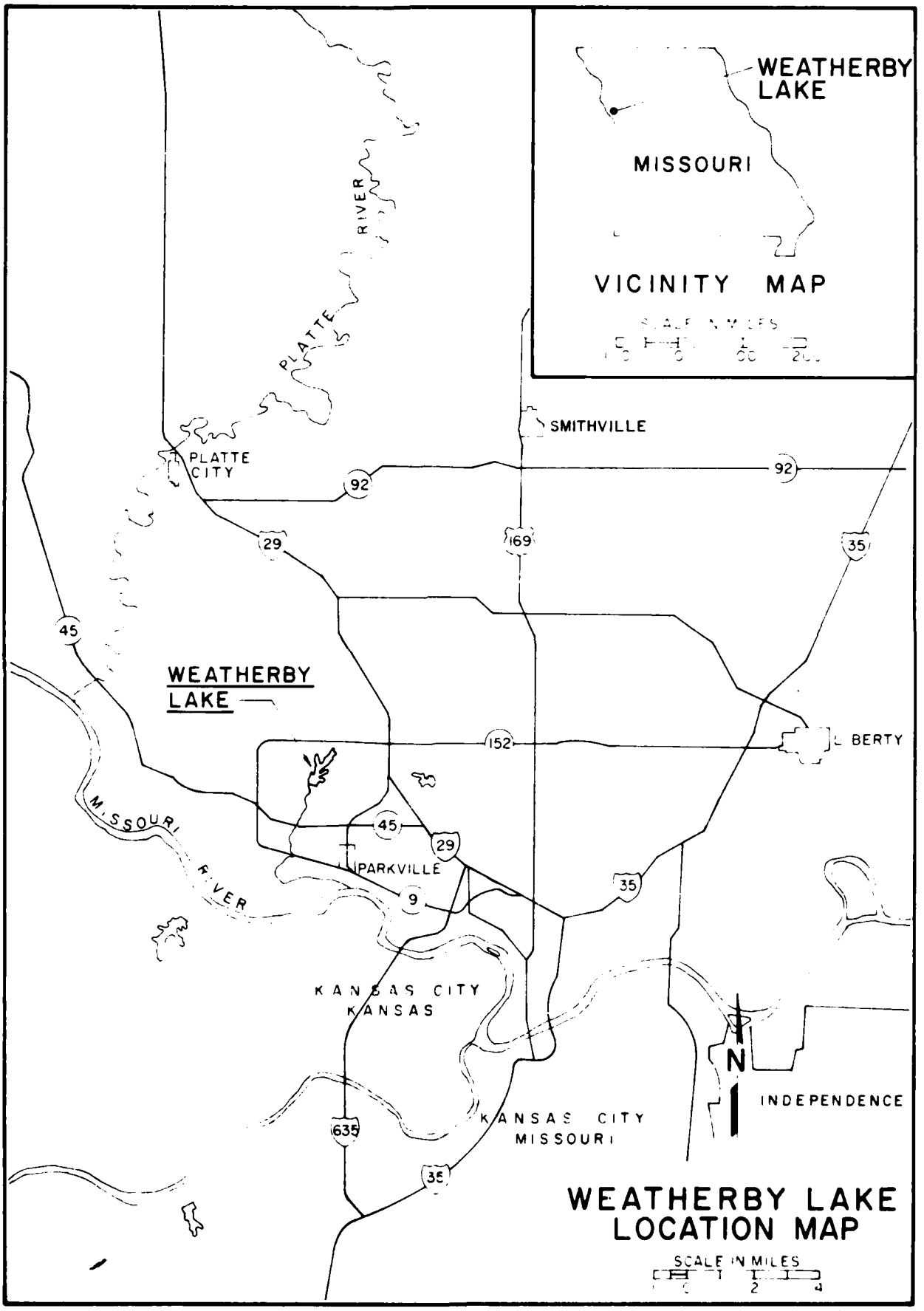
(1) Check the downstream face and abutments of the dam periodically for seepage and stability problems. If increased seepage flows or additional sliding on this downstream embankment are observed, the dam should be inspected and the pending condition evaluated by an engineer experienced in design and construction of earthen dams.

(2) A regular maintenance program should be initiated to control the growth on downstream slope of the dam.

(3) An engineer experienced in the design and construction of earth dams should be retained to develop procedures to prevent further erosion of the downstream embankment slope and undercutting of the concrete discharge exit apron.

(4) Additional erosion protection should be added on the upstream slope in the areas of riprap movement. This protection is needed to prevent erosion of the embankment material due to wave action.

(5) A detailed inspection of the dam should be made annually by an engineer experienced in design and construction of dams. More frequent inspections may be required if additional deficiencies are observed or the severity of the reported deficiencies increases.


WEATHERBY LAKE
MISSOURI
VICINITY MAP
PLATTE RIVER
SMITHVILLE
PLATTE CITY
92
29
169
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WEATHERBY LAKE
152
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MISSOURI RIVER
PARKVILLE
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KANSAS CITY KANSAS
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INDEPENDENCE
KANSAS CITY MISSOURI
635
WEATHERBY LAKE LOCATION MAP
SCALE IN MILES

PLATE 1

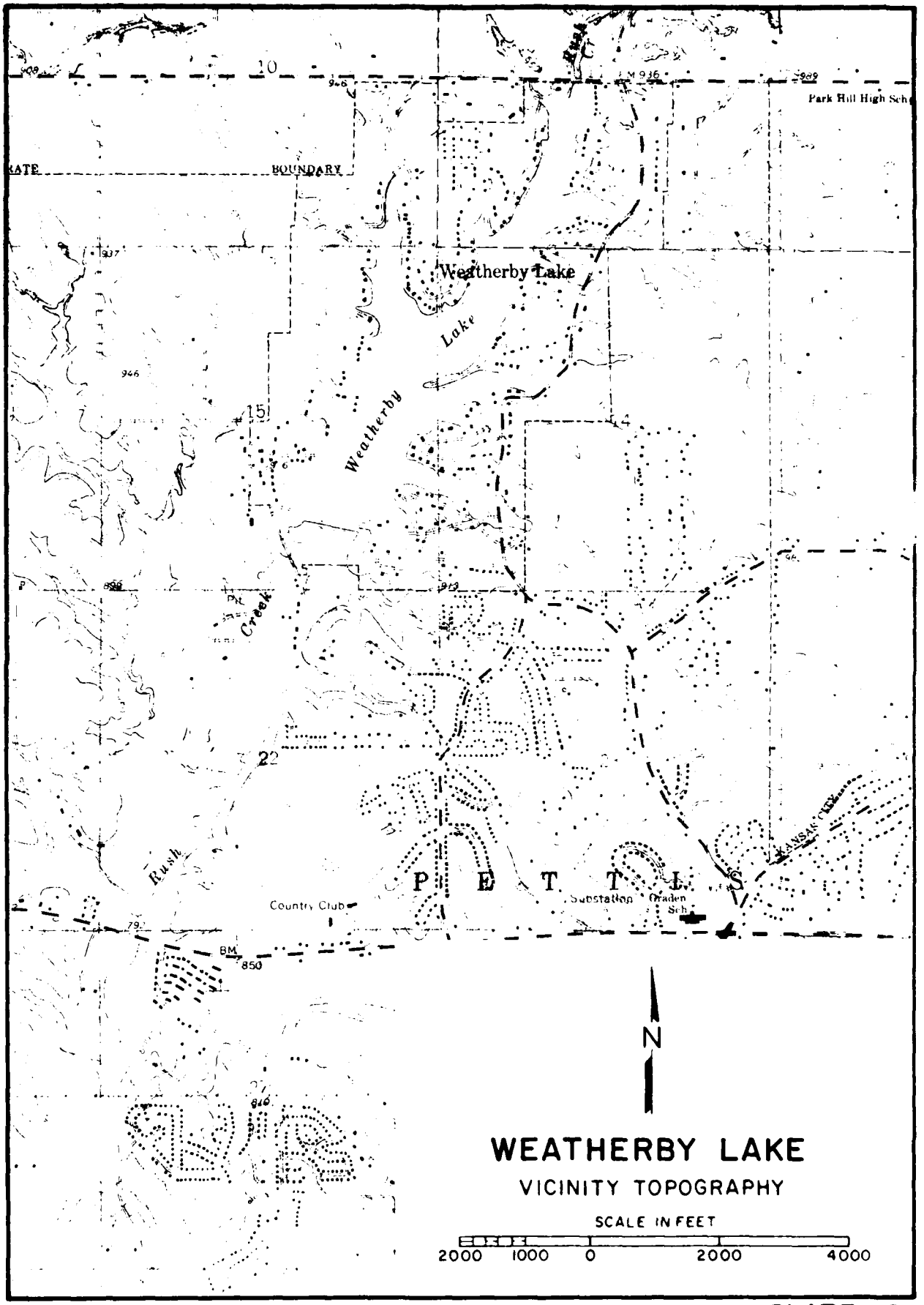
Park Hill High Sch
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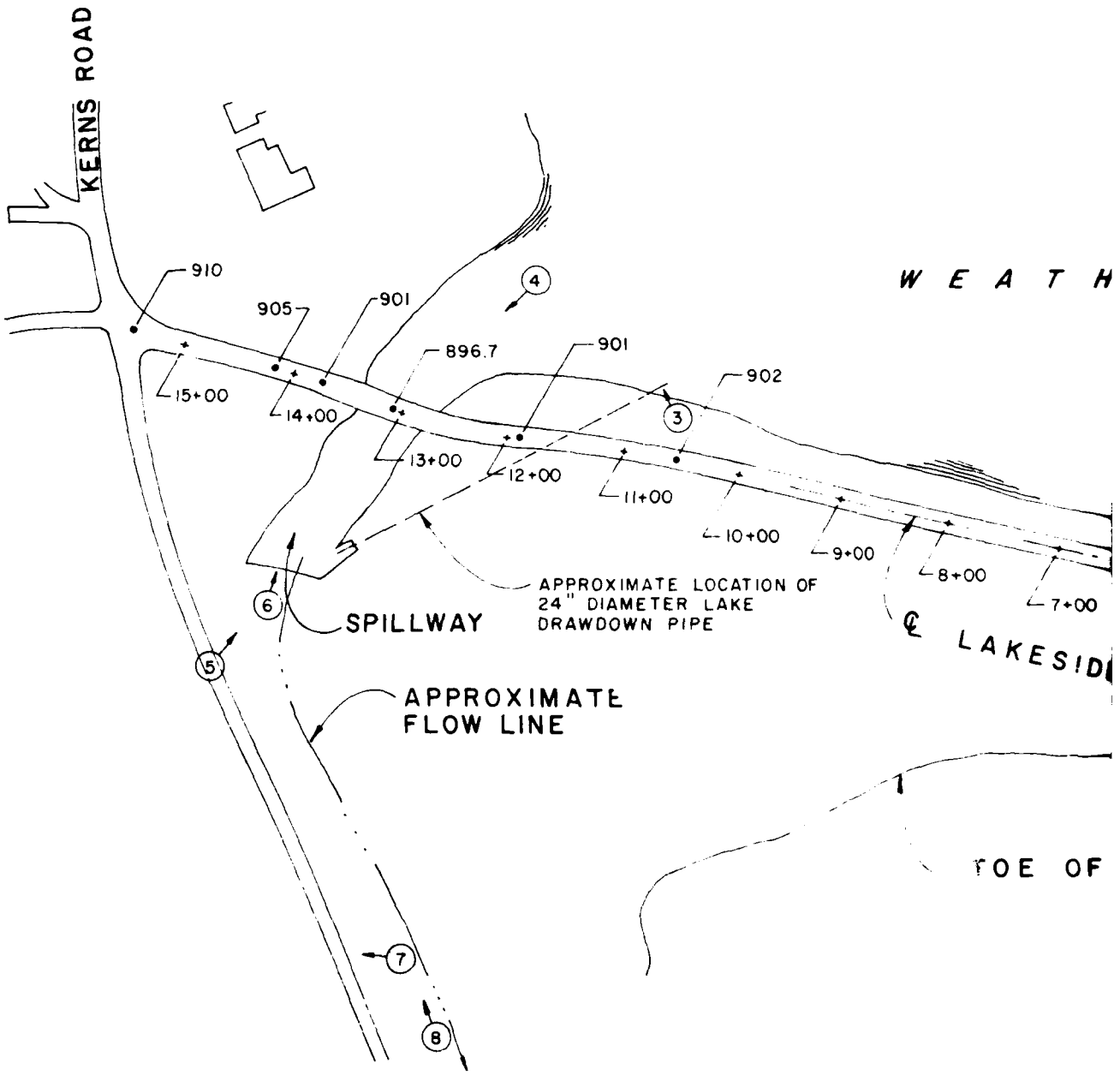
PLATE 2

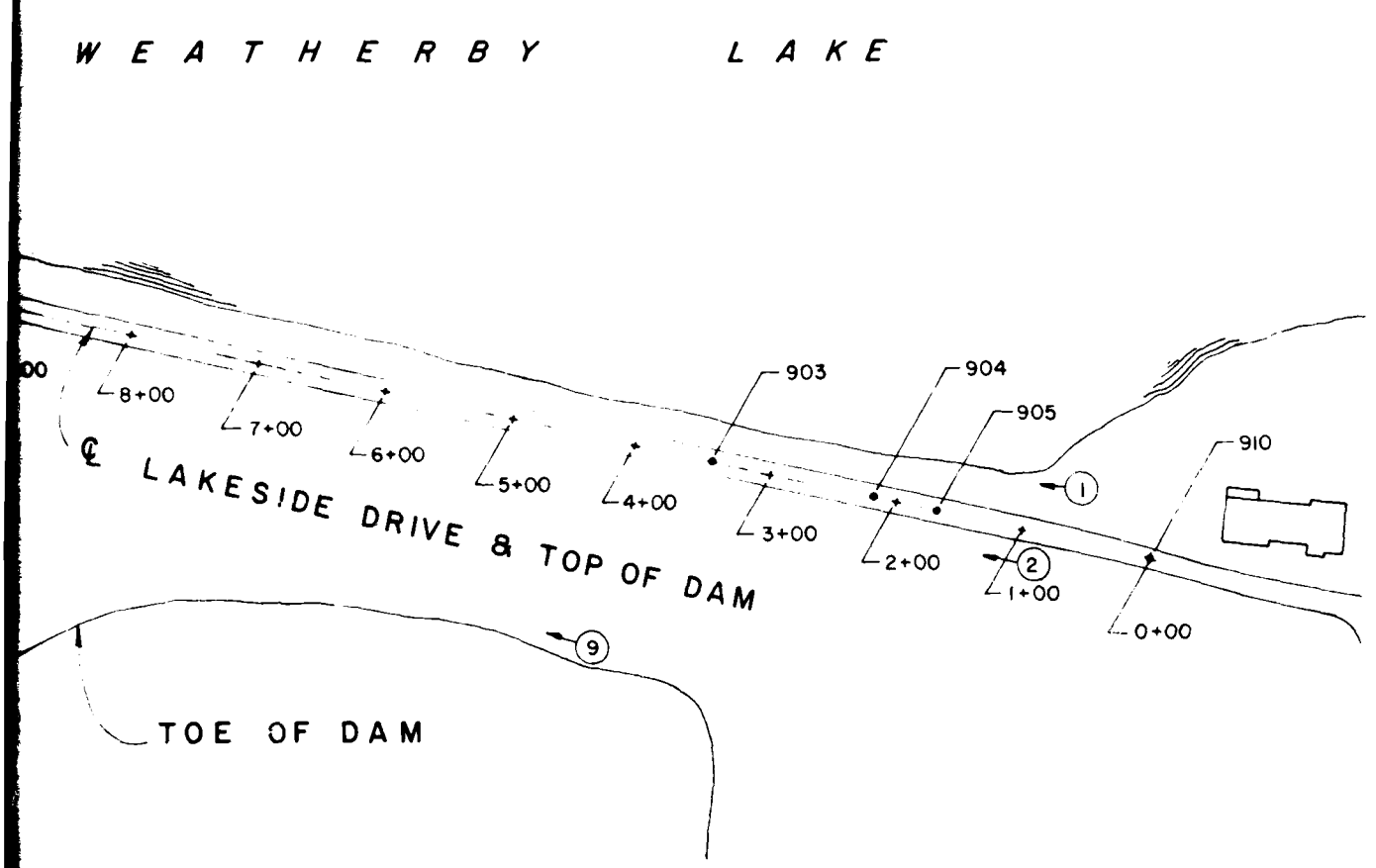


LEGEND

910 — ELEVATION IN FEET ABOVE MEAN

2+50 — STATIONING (2+50 = 250' FROM

(1) — NUMBER AND DIRECTION OF PHOTO



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N FEET ABOVE MEAN SEA LEVEL (MSL)

2+50 = 250' FROM 0+00)

IRECTION OF PHOTOGRAPH

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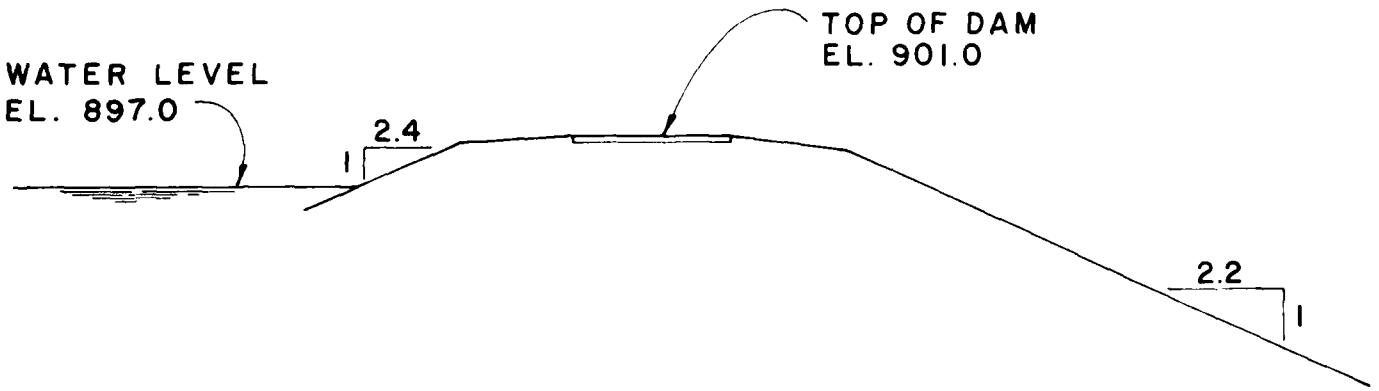
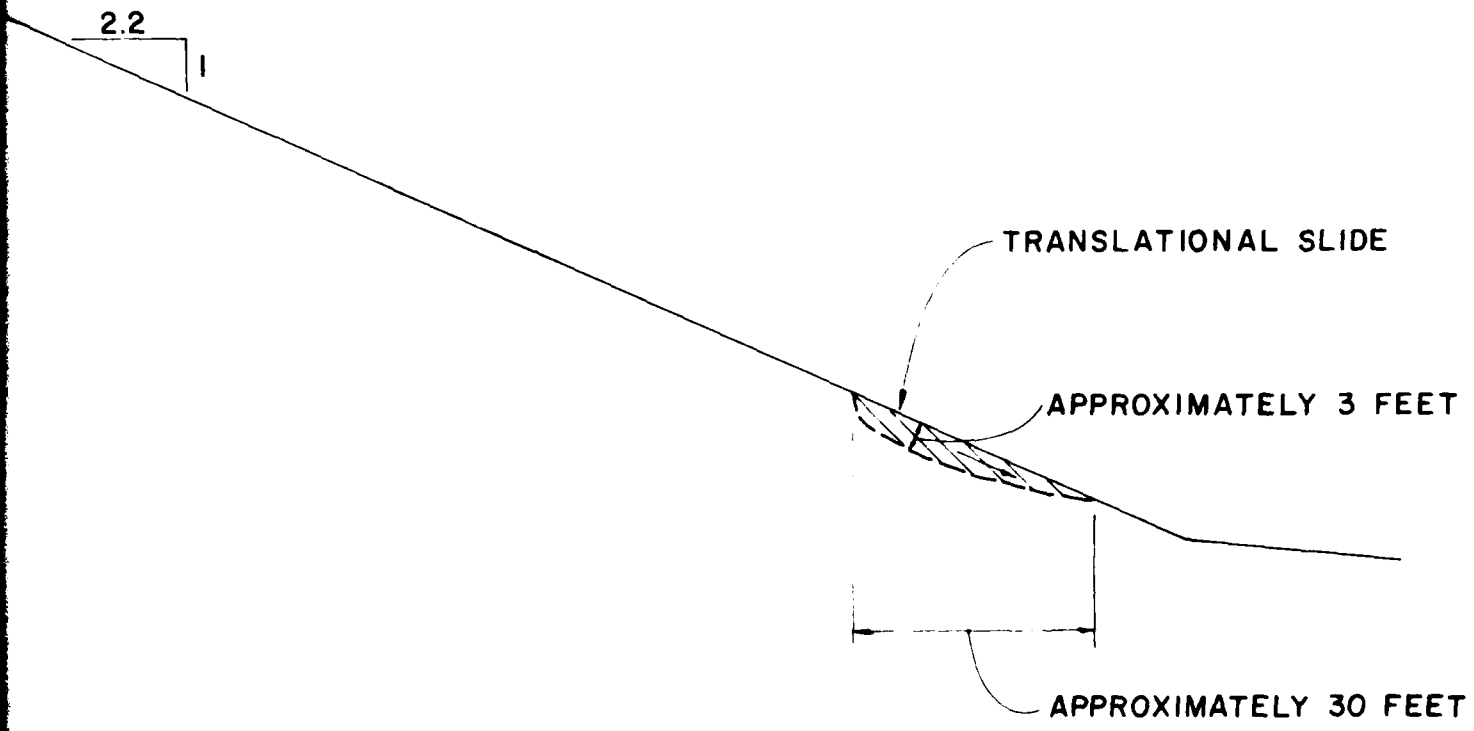
WEATHERBY LAKE PLAN

PLATE 3

1 2

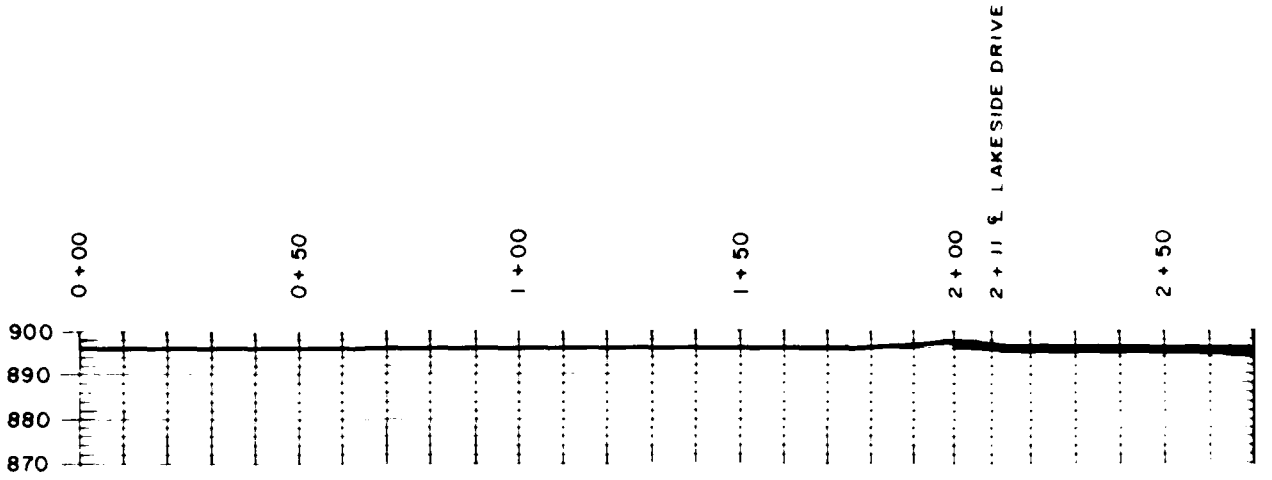

TOP OF DAM
EL. 901.0
WATER LEVEL
EL. 897.0
2.4
1
2.2
1



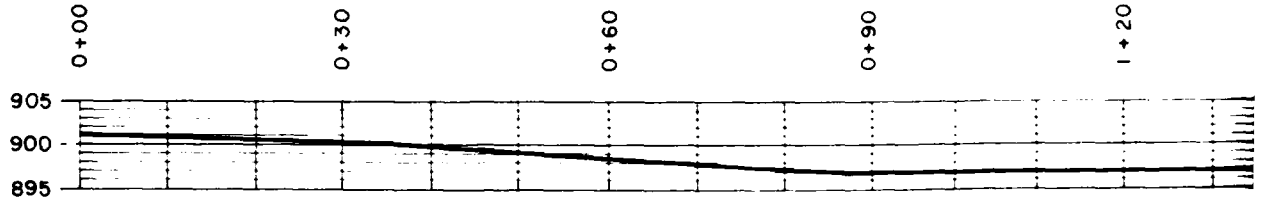
WEATHERBY LAKE
TYPICAL SECTION

PLATE 4

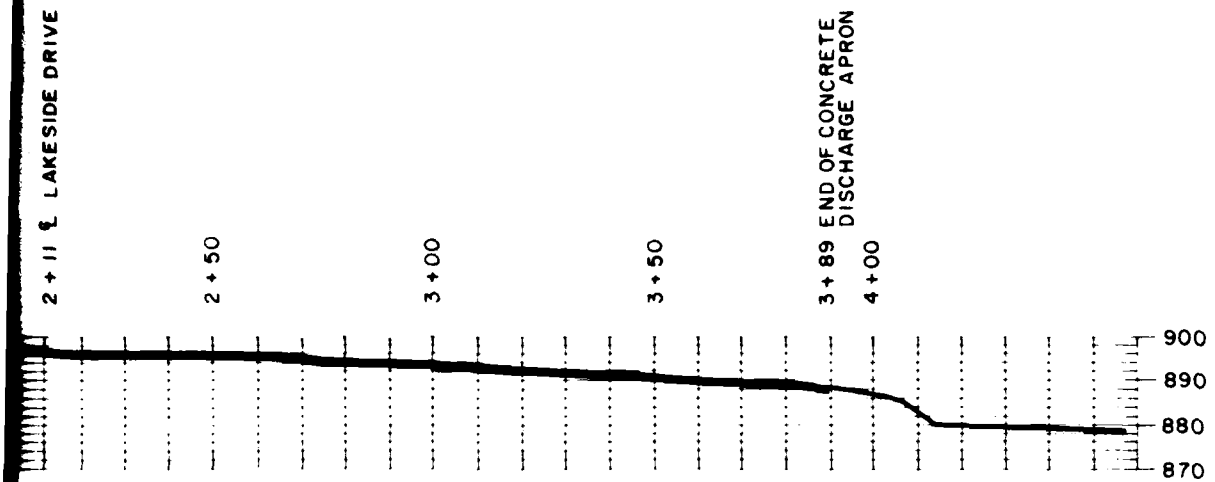
12



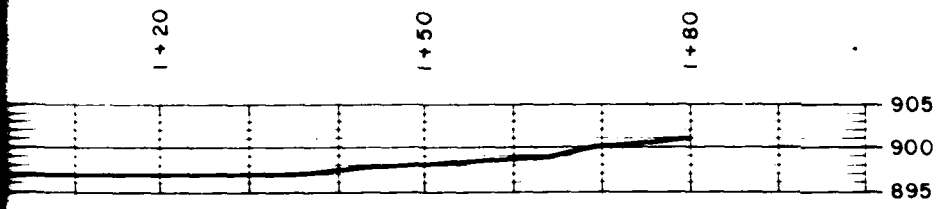
SPILLWAY PR



SPILLWAY X-SECTION AT ℄ LA



AY PROFILE



AT ℄ LAKESIDE DRIVE

WEATHERBY LAKE
SPILLWAY DETAILS

PLATE 5

PHOTO 1: Upstream Face of Dam (Looking West)

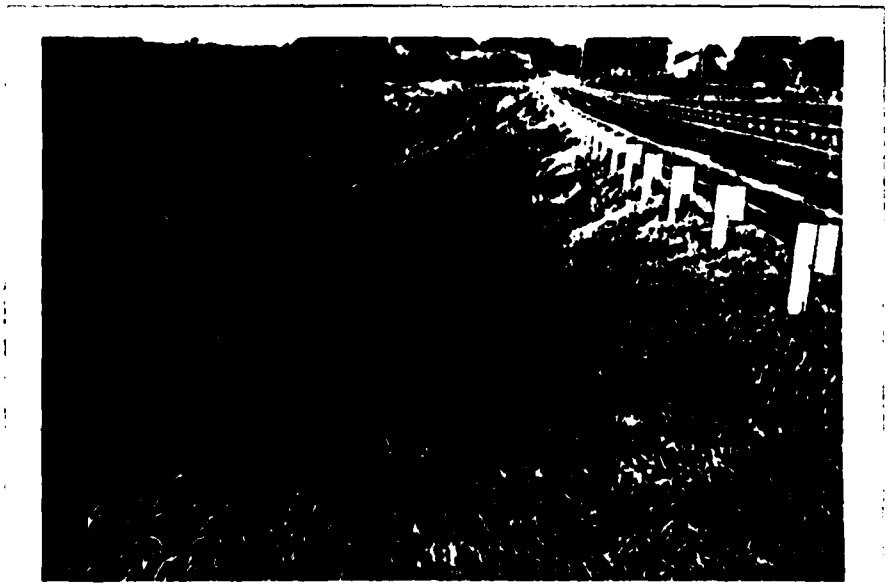


PHOTO 2: Downstream Face of Dam (Looking West)

PHOTO 3: Inlet of 24-inch Diameter Outlet Pipe

PHOTO 4: Spillway Approach Channel (Looking South)

PHOTO 5: Spillway Discharge Channel (Looking North)

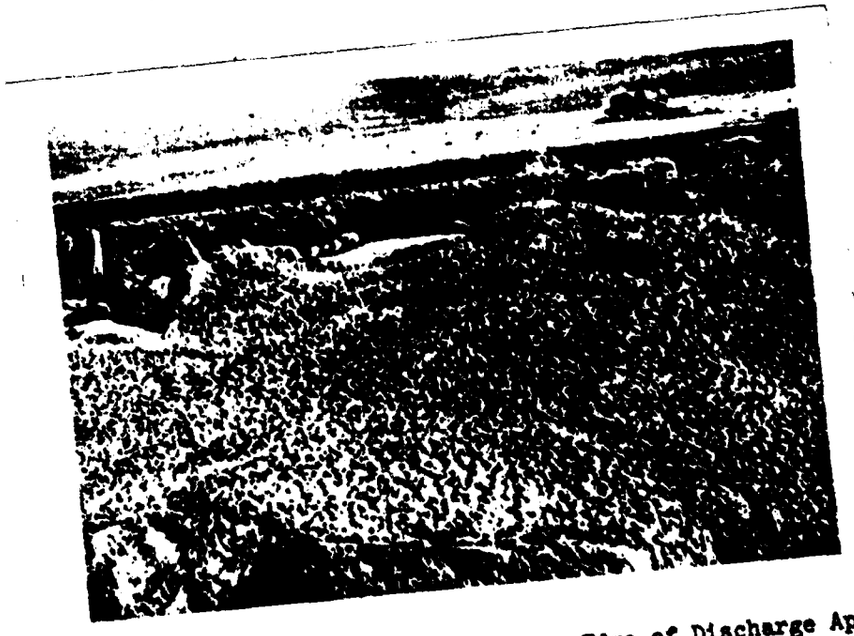


PHOTO 6: Undercutting at Downstream Edge of Discharge Apron

PHOTO 7: Seepage in Limestone and Shale Formations.

PHOTO 8: Seepage in Plunge Pool Area

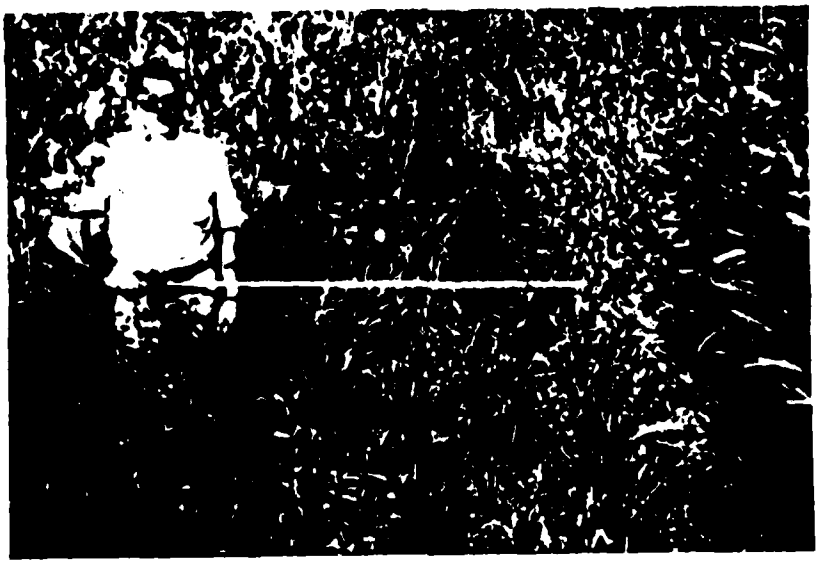


PHOTO 9: Sliding of Downstream Embankment

APPENDIX A

HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Soil Conservation Service (SCS) dimensionless unit hydrograph and HEC-1 (1) were used to develop the inflow hydrographs (see Plates A-1, A-2, and A-3), and hydrologic inputs are as follows:

a. Twenty-four hour, probable maximum precipitation determined from U.S. Weather Bureau Hydrometeorological Report No. 33.

200 square mile, 24 hour rainfall inches	- 24.5
10 square mile, 6 hour percent of 24 hour 200 square mile rainfall	- 101%
10 square mile, 12 hour percent of 24 hour 200 square mile rainfall	- 120%
10 square mile, 24 hour percent of 24 hour 200 square mile, rainfall	- 130%

b. Drainage area = 2,750 acres.

c. Time of concentration: $Tc = (11.9 \times L^3/H)^{0.385} = 0.89$ hours = 53 minutes (L = length of longest watercourse in miles, H = elevation difference in feet) (2)

d. Losses were determined in accordance with SCS methods for determining runoff using a curve number of 78 and antecedent moisture condition III.

2. Spillway release rates are based on backwater analysis through the spillway and approach channels using HEC-2(3).

Discharge rates over the top of the dam are based on the broad-crested weir equation:

$Q = CLH^{1.5}$ (C = 2.6, L = 30 to 1100 feet, H is the head on weir)

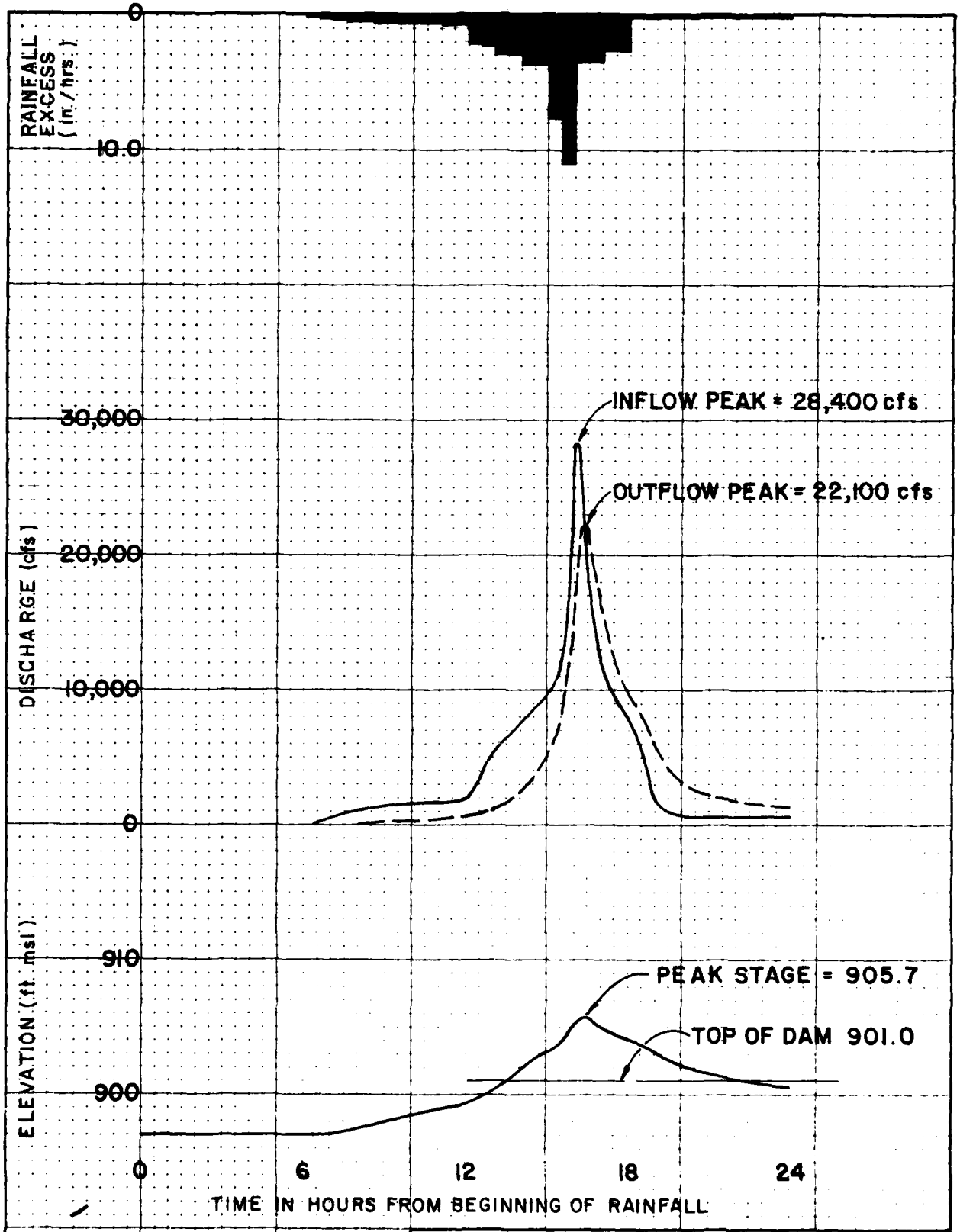
3. The elevation-storage relationship above normal pool elevation was constructed by planimetering the area enclosed within each contour above normal pool. The storage between two elevations was computed by multiplying the average of the areas at the two elevations by the elevation difference. The summation of these increments below a given elevation is the storage below that level.

4. Floods are routed through the spillway using HEC-1, modified Puls to determine the capability of the spillway. Inflow and outflow hydrographs are shown on Plates A-1, A-2, and A-3.

(1) U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1), Dam Safety Version, July 1978, Davis, California.

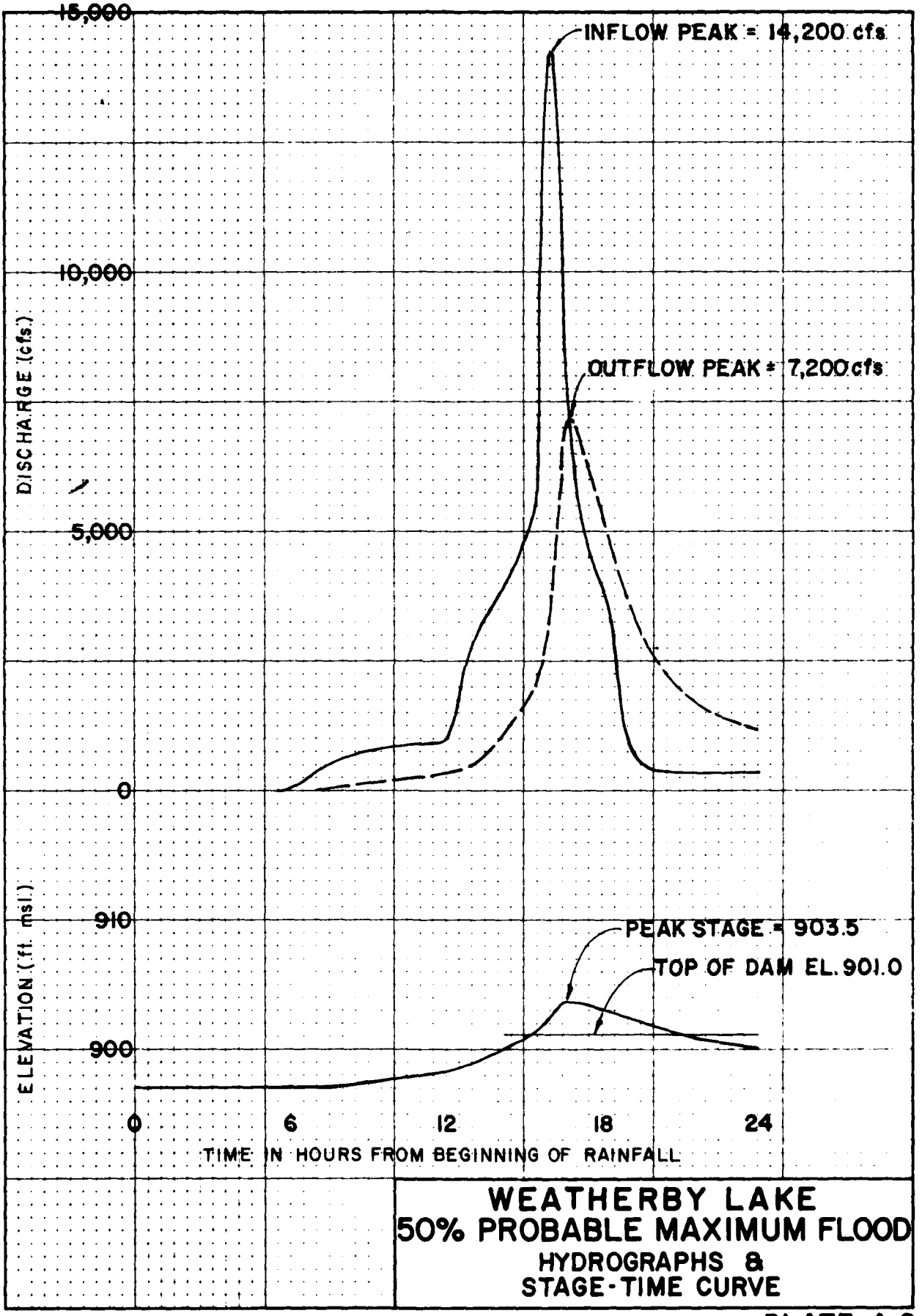
(2) U.S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, 1974, Washington, D.C.

(3) U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2, Water Surface Profiles, November, 1976, Davis, California.



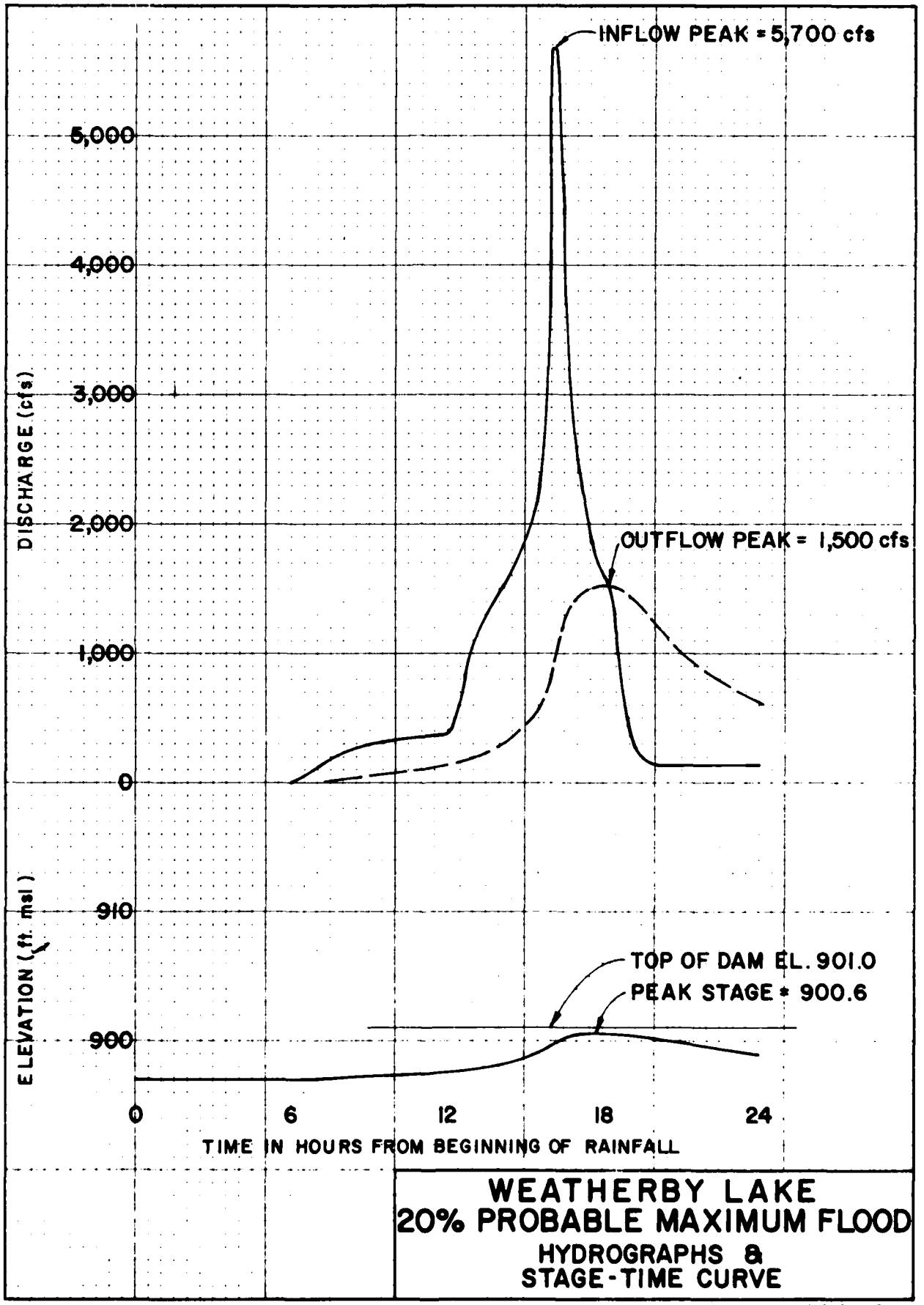
WEATHERBY LAKE
PROBABLE MAXIMUM FLOOD
HYETOGRAPH, HYDROGRAPHS & STAGE-TIME CURVE

PLATE A-1



WEATHERBY LAKE
50% PROBABLE MAXIMUM FLOOD
HYDROGRAPHS & STAGE-TIME CURVE

PLATE A-2



WEATHERBY LAKE
20% PROBABLE MAXIMUM FLOOD
HYDROGRAPHS & STAGE-TIME CURVE

PLATE A-3

TYPICAL SECTION

PLATE 4